Nursing Informatics 2014
K. Saranto et al. (Eds.)

doi:10.3233/978-1-61499-415-2-371

Opportunities in Interdisciplinary Care Team Adoption of Electronic Point-of-Care Documentation Systems

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Abstract. We conducted three evaluation studies in community and hospital settings to examine point-of-care documentation system adoption among interdisciplinary care team clinicians. In the community settings, quantitative methods included documentation time-to-completion and a clinician satisfaction survey. Qualitative methods included observations and follow-up interviews. Qualitative data and quantitative data were merged comparing findings along themes. In the hospitals, qualitative scenario testing results indicated clinician system adoption was universal, though not always timely. At all sites, mismatch between system functionality and workflow was a barrier to clinician system access during patient care and reduced clinician efficiency. Clinicians at all settings were satisfied with their ability to access other clinicians' notes, without increased interdisciplinary team communication. Clinicians did not identify any systems impact on patient outcomes. To facilitate adoption, clinicians should see the value of using the system as intended by receiving system data feedback that shows improvement of patient care and patient safety.

Keywords: Evaluation studies; clinical information systems; patient care team

Introduction

Interdisciplinary care teams, primarily nurses, deliver most health care in the United States and worldwide. A high level of planning and communication is required to coordinate care properly among the members of these teams [1]. It is expected that point-of-care documentation systems can support the coordination required to improve quality and safety of care. These point-of-care documentation systems, intended to be used at the patient's side as clinicians provide clinical care, include electronic health records (EHR) and nursing information systems (NIS). Little is known about the barriers and facilitators to adoption of point-of-care documentation systems by interdisciplinary care teams. To identify such barriers and facilitators, we conducted

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three HIT evaluations: studies at each of two community health sites and a study in two hospitals in an acute care hospital system.

1. Methods

Both community studies used an embedded mixed-methods design with similar procedures to collect and analyze clinician-reported and actual system usage data related to satisfaction with the system [2] (Table 1). We used scenario testing with qualitative analysis to assess clinician satisfaction and usage in the hospital study (Table 1). Institutional review boards approved the studies.

Table 1. Data collection and analytic methods

Data Collection Method	Analysis	PACE	Home Care	Hospital
Observation	Content analysis	X	X	
Satisfaction survey (EHRNS)	Descriptive statistics	X	X	
Follow-up interviews	Content analysis	X	X	
Time-to-completion documentation	Analysis of variance; logistic regression	X	X	
Reimbursement	Descriptive statistics		X	
Patient outcomes	Descriptive statistics		X	
Scenario testing	Content analysis			X

The community studies design included mixed methods. The quantitative component in the Program of All-Inclusive Care for the Elderly (PACE) and home care studies used retrospective data (actual system usage) and post-intervention prospective data (clinician satisfaction surveys) without a comparison group. The embedded qualitative component consisted of prospective data for post-intervention observation and interviews. Quantitative data (the primary data set) and qualitative data were analyzed concurrently and used to inform each other to enrich the interpretation of findings [3]. The scenario study design used at two hospitals was presented as a modified think-aloud protocol. This protocol is a standard method used to elicit data about cognitive reasoning that occurs during a problem-solving task [4]. Users were presented with typical usage scenarios and allowed to walk through how they would complete the action requested when they used the NIS.

1.1. HIT Evaluation Framework

The authors used the Health Information Technology (HIT) Reference-based Evaluation Framework (HITREF) in the mixed-methods studies in community settings to integrate results from the quantitative and qualitative segments and to identify how the qualitative themes contributed to understanding the quantitative findings. In the scenario study design, the HITREF was used to label themes that emerged from content analysis. The HITREF is a comprehensive HIT evaluation framework; it is firmly grounded in research evidence that identifies a range of clinician satisfaction

characteristics and dimensions to be measured [2]. It provides a comprehensive list of 20 criteria as themes for the study analyses and was operationalized in clinician satisfaction surveys used in community health site studies [5].

1.2. Study Settings

The studies were conducted in two community settings and in two acute care hospitals from one health care system in Philadelphia, PA (Table 2). At all of the sites, multidisciplinary teams delivered direct patient care and documented in a point-of-care documentation system. These teams, which were predominantly nurses, also included social workers, physical therapists, and occupational therapists. All settings were part of the same integrated health care system that provided server and infrastructure support. The PACE site managed the care of nursing-home eligible members to enable them to avoid nursing home admission and to reside in their homes [6]. The PACE EHR implementation goal was to enable clinicians to provide at least the same level of care to an increasing number of patients.

The goal of the home care agency in implementing the point-of-care EHR was to improve overall operations. Specific goals included improving clinical quality by aggregating data in real time and improving patient safety with documentation that was timely, in one place, and available in real time to all clinicians. A staff of five full-time equivalent technologists supported the home care EHR and the HIT in two related organizations of similar size. One hospital site was the flagship 760-bed teaching hospital for the four-hospital system. The second hospital in the study was a 300-bed teaching hospital. The health system's goal in implementing the NIS in the hospitals was to promote patient safety and improve patient outcomes by (1) standardizing care and reducing variability in clinical practice among the clinical disciplines on the multidisciplinary care team through the use of evidence-based clinical practice guidelines (CPG) and (2) supporting the nurses who provided patient-centered care. Nursing leaders expected that the NIS would save time, enhance patient confidentiality, and improve the quality of care provided.

Table 2. Research study settings

Characteristic	PACE	Home Care	Hospital
Patients	338	1200/month	3 units
Clinicians	39	137	12
System	EHR	EHR	NIS
Year implemented	2007	2009	2011
Commercial	Yes	Yes	Yes
Study time period	9/08–3/09	1/08–4/11	3/12–5/12

1.3. Interventions

The selected sites had implemented commercially available point-of-care documentation systems for use by interdisciplinary teams. EHR were implemented in the PACE site in October 2007 and in the home care site in 2009. Both EHR supported

documentation management of medications and patient history. The PACE EHR also supported ordering diagnostic tests and nonmedication orders, managing results, and capturing external clinical documents with scanning. The home care EHR supported sharing patient information among clinicians and had limited interoperability of referrals from health system hospitals. Neither EHR supported workflow management, clinical task assignment/routing, clinical decision support, or interoperability with off-site organizations performing clinical services (e.g., laboratories). The hospitals implemented an NIS in 2011 that functioned with the Computerized Provider Order Entry system within the EHR. Nurses selected from the NIS approximately 200 interdisciplinary evidence-based CPG to guide and document patient care; nurses also individualized patient care plans using the CPG. Content from the care plan populated throughout the assessment plus education flow sheets produced a comprehensive, detailed assessment specific to the plan of care, prompting nurses to recognize important elements of the selected care plan.

1.4. Quantitative and Qualitative Methods

The PACE investigation focused on cross-sectional analyses and comparisons between two sets of post-implementation results that were obtained 6 months apart [2]. The analysis of the home care study focused on longitudinal analyses using ANOVA for continuous outcomes and comparisons between pre-implementation (11/07–2/09) and post-implementation (8/09–2/10) time periods [7]. Qualitative data were analyzed using content analysis in the three studies. In each study, all clinicians who provided direct patient care and documented in the point-of-care electronic system were eligible to participate at different levels in each method. For instance, all PACE and home care clinicians were included in analyses of time to completion of documentation. Only clinicians who consented to participate were observed, surveyed, and interviewed. Consent was sought in the PACE and home care studies from all clinicians who attended on-site staff meetings and in the home care study with letters sent to the clinicians' homes. In the hospital study, a convenience sample of consented clinicians from selected floors participated in the scenario testing.

1.5. Clinician Satisfaction

Observation, surveys, and interviews were used to assess clinician satisfaction with the impact of EHR on clinical process in the PACE and home care studies. The EHR Nurse Satisfaction (EHRNS) survey [5] was administered in the PACE and home care studies. In the hospital studies, clinician satisfaction was assessed from responses made during scenario testing. PACE and home care clinicians were observed during a patient visit to see what information the clinicians recorded and where in the EHR the clinicians recorded the information. Clinicians were selected by work sampling [8] to cover each clinical role and each team. Clinicians were observed until saturation; that is, until observations offered no new information, or a functionality was seen at least three times [9]; Frattaroli S, 2007, personal communication]. In the PACE and home care agency, following observation and survey administration, semi-structured interviews were conducted (PS) until saturation was obtained from clinicians eliciting information about their areas of concern or satisfaction with the EHR. Content analysis of interview responses started with the HITREF, followed by a mapping of the coded themes to the HITREF, thereby creating a conceptualization that encompassed all

participants' experiences. Satisfaction of hospital nurses with the NIS was assessed using scenario testing, which entailed the researchers' presenting to participants previously prepared scenarios and follow-up interview questions while observing their use of the system in a conference room on the unit. A different set of scenarios and questions was asked of each participant, ensuring that all scenarios and questions were asked at least once for each unit. Nurses were recruited until saturation was reached. For each audio-recorded transcript, researchers (KB, PS, MR) coded themes independently and then together coded them in relation to the HITREF. A 10% double reliability check was performed.

1.6. Documentation Usage

Actual usage of the documentation system was assessed with universal usage and timeliness of documentation in the PACE and home care studies. Hospital documentation usage and timeliness data were garnered from clinician responses during scenario testing.

2. Results

We report PACE, home health agency, and hospital study results (Table 3).

Table 3. Barriers and facilitators to adoption of point-of-care documentation systems

Theme	PACE	Home Care	Hospital
Computer placement	No impact	No impact	− Number of computers outside patient rooms
Usability	− Navigation	− Navigation	− Navigation; mismatch screenflow/workflow; documentation fatigue
Clinician involvement	+ Throughout process	− Training	NIS not valued
Organizational support	+ Support	−Field support, training	− Training
Quality of data	− Timely, complete	+ Timely, complete	+ Accessible, complete
Efficiency	− Increased printing	− Increased documentation	− Bottlenecks; redundant documentation; many checkboxes
Team communication	No impact	+ Facilitated	No impact
Impact on clinical process	No impact	+ Memory jogs; display timely information; − Patient rapport	+ Improved access to information, increased time at bedside − Less patient time, more NIS time; patient rapport
Impact on patient outcomes	No impact	Some impact	Not assessed
Interoperability	− Needed	− Needed	Not mentioned

2.1. Clinician Satisfaction

Thirty-seven PACE clinicians (95% of eligible clinicians) completed the first EHRNS survey, and 32 clinicians (82%) completed both surveys. The average survey

respondent was an experienced, middle-aged, female nurse with prior EHR experience and average computer skills. Overall, clinicians were satisfied with the impact of the EHR on the clinical process. They were not satisfied with Usability (e.g., user friendly) or Clinician Involvement in EHR Selection, Development, or Training (e.g., design). Four primary care PACE practitioners (nurse practitioners and physicians) participated in follow-up interviews after administration of the first survey; six primary care practitioners participated in follow-up interviews after administration of the second survey. Their responses to the interview questions were mostly negative (96%) and focused on clinical process in the following areas: (1) computer placement; (2) finding/documenting information; (3) usability issues; and (4) lack of interoperability from external sources.

In the home care study, 59 of the 137 home care clinicians (43%) completed EHRNS surveys. The average home care respondent was similar in demographics and prior experience to the average PACE respondent, although fewer home care respondents (33%) had prior EHR experience. There were 8 home care clinicians (6%) who were observed and interviewed. Home care clinicians were satisfied with the EHR overall but not satisfied with Clinician Involvement, Unintended Consequences (e.g., EHR problems that interfere with patient care), or Costs of Computers (e.g., contributes to increased healthcare costs). They commented on hardware, usability, and efficiency issues related to documentation usage discussed above. They were dissatisfied with lack of interoperability and interference with establishing rapport with patients.

Hospital nurses universally preferred documenting in the NIS rather than returning to paper records. Nurses were satisfied with the impact of NIS on (1) time spent at the bedside; (2) memory prompts; (3) access to information; (4) efficiency; and (5) interdisciplinary communication. Nurses were dissatisfied with (1) number of computers; (2) usability; (3) inefficiencies; (4) documentation fatigue induced by repetitively clicking checkboxes; (5) amount of time spent documenting in the NIS; (6) interference of NIS with the nurse's ability to give the patient his/her full attention; and (7) lack of communication about NIS changes.

2.2. Documentation Usage

Across the three studies, clinicians universally used the documentation system with variation as to whether the system was used as intended at the point of care. PACE clinicians were familiar with their patients and consulted the EHR infrequently. Home care clinicians documented in the EHR during the visit and also made notes on paper. Nurses began entering admission information in the EHR and wrote the balance of the documentation on paper for entry later. Clinician use of the home care EHR at the point of care supported the clinical process and also reduced efficiency. Hospital nurses reported that they tended to use the NIS in the patient room for some documentation tasks and to document assessments outside the room.

Analysis of actual usage findings indicated some documentation was completed sooner in the PACE site and that overall documentation was timelier in the home care site. In the PACE site, the range of days for note completion decreased from 271 days in the first period to 90 days in the second period, whereas the median remained at 0 days. Home care clinicians in the post-implementation period were 18.8 times (95% CI: 17.9-19.7) more likely to be in compliance with completion guidelines (within 1 day) in comparison to clinicians in the pre-implementation period (7 days).

3. Discussion

We evaluated interdisciplinary team use of point-of-care EHR in PACE and home care and of point-of-care NIS in hospitals. We summarized the barriers and facilitators to clinician adoption of these systems for informaticians seeking to assess how point-of-care systems affect the clinical process and ultimately patient outcomes. Given the limitations of the small sample size and the lack of comparison groups, these studies should be considered exploratory.

At the study sites, adoption by clinicians of the point-of-care systems for documentation was universal although not always at the point of care. In the PACE and home care studies, system implementation resulted in improved timeliness of the data. These clinicians would have liked the patient data to have been more complete and their EHR systems to have been interoperable with hospital systems.

At each site, system functionality was, however, cumbersome to use or did not support the clinical workflow, which introduced inefficiency in the clinical process. This mismatch between system functionality and workflow was a barrier to clinician access to the system during patient care. Also, efficiency was decreased due to hardware and technical issues that delayed clinicians' being able to enter data. In the hospital study, nurses reported clicking through checkboxes that did not provide new information. This situation represented a missed opportunity for the NIS to decrease clinicians' cognitive load. Some clinicians perceived that use of point-of-care systems increased the time spent documenting, thereby decreasing the amount of time available for other patient care-related activities. Although a hospital study reported similar findings [11], a national survey found that nurses perceived that EHR use did not change how they allocated their time during their workday [12]. In addition, clinicians felt that point-of-care documentation interfered with patient rapport, which was also reported in the hospital study [11]. Documenting on paper during the visit was not viewed as an obstacle, possibly because clinicians had been using paper since their clinical education. Incorporating the use of electronic documentation systems in clinical education may improve clinicians' facility and comfort with using computers at the point of care in their practice. Clinicians were also satisfied with use of the computer at the point of care to access notes from other clinicians. Matching system functionality and usability to workflow, while complex, is necessary to achieve the promise of clinical information systems in improving the safety, quality, and efficiency of patient care [10].

There was a need for continuous feedback from front-line users to improve education. As well, on-going training would better inform clinicians about recent changes in software functionality or how to better fit their use of the system to their workflow. One solution may be to use a nurse mediator team to anticipate and resolve system/workflow implementation issues as described in a recent study [13].

The research sites shared similar goals for implementing their systems: improve quality of patient care and patient safety. Furthermore, clinician satisfaction with the impact of the system on patient outcome is a likely facilitator to adoption [14]. However, only clinicians in the home care study, where clinicians practice independently in the patient's home, perceived that system use had a positive impact on team communication. Clinicians from the three studies did not perceive any impact of the systems on patient outcomes. Despite some benefits, clinicians viewed using the system as just one more task and did not value the system. If clinicians do not see the value in the system for patients, they are less likely to use it. Administrators can

demonstrate the value of clinician documentation in the system by providing front-line clinicians with feedback about key metrics related to quality of care and patient safety. The source of this feedback can be data captured by the EHR or NIS and subsequently analyzed. The national survey found that nurses working in organizations with EHR were more likely to report quality improvement and nursing excellence efforts [12]. Clinicians should be aware that the data they record in these systems are the source for these improvement efforts.

4. Conclusion

We suggest that health care site managers who are planning to deploy a point-of-care documentation system for use by interdisciplinary care teams consider assessing the system's functionality and usability in regard to the site's workflow before, during, and after the implementation. The goal is that clinicians use the system as intended, realizing its benefits as a memory aid and as a means of team communication for timely and appropriate patient care. In addition, systems in community settings should be interoperable to improve clinician access to patient data from off-site services or care. Furthermore, to facilitate clinician adoption, clinicians should see the value of using the system as intended by receiving feedback from system data that shows improvement in patient care and patient safety.

Acknowledgments

Agency for Healthcare Research and Quality 1R21HS021008-01; Drexel University Career Development Grant; National Library of Medicine/Robert Wood Johnson Foundation Public Health Informatics Training T15LM07452; Johns Hopkins University School of Medicine. Barbara Granger for editorial expertise.

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